

# THE NORTH PLATTE VALLEY TORNADO OUTBREAK OF JUNE 27, 1955

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## ABSTRACT

The largest and most devastating tornado in the history of western Nebraska occurred on June 27, 1955, in the North Platte Valley. The storm path and damage are described and two personal accounts of encounters with the center are presented. Selected pictures from a large collection of photographs are reproduced and used to determine the width and height of the funnel and of other features. Radar pictures show the characteristic "hook" or "number 6" appearance of the associated cloud. Aerial photographs of unusual markings apparently made by the tornado on a field near Scottsbluff are scaled and used with certain assumptions to obtain an estimated surface wind of 484 m. p. h. in the funnel. Information is given on observed downdrafts, sense of wind rotation, shape of the cloud protuberance, and associated weather conditions.

## 1. INTRODUCTION

Tornadoes are not strangers to western Nebraska but records indicate that tornadoes in that part of the State are usually small. They act more like large whirlwinds than real tornadoes. The natives call these "twisters." Rare indeed is the tornado that does more than scatter a hay stack or blow over an isolated farm building. The tornado situation of June 27, 1955, was a rare phenomenon for it produced the largest and most devastating tornado in the history of western Nebraska. In size and force this phenomenon was comparable to tornadoes in any State in the Union. Destruction was spread along the path from Henry, Nebr., near the Wyoming-Nebraska line, where a tornado struck at 3:30 p. m., MST, down the North Platte Valley to about 8 miles east of Scottsbluff, Nebr., where the largest of the observed funnels dissipated about 5:20 p. m., MST. This path is over 30 miles in length (see fig. 1).

## 2. PATH AND DAMAGE

The first sign of a tornado in Nebraska<sup>1</sup> on June 27 was observed by a local citizen at Henry, Nebr. He was looking west toward Wyoming watching a dark cloud moving toward him. As the cloud moved near it passed over a flooded field along the North Platte River, and a column of water spray was seen to rise up from the surface and form a column about 8 feet in height and 4 feet in diameter. The observer compared the water column to a shock of corn and reported that water appeared to spray upward and outward from the top of the column. Perhaps he was the first person ever to see a waterspout in Ne-

braska. He observed no funnel or protuberance below the cloud but time did not permit a complete study as the "waterspout" was moving directly toward the observer who, having been alerted to the possibility of a tornado, sought shelter. The occurrence of the "waterspout", its size, shape, and location, was verified by another observer.

A tornado moved directly over the village of Henry with damage only to cottonwood trees. These tall trees extended above the low buildings. It appeared as though a giant hand had reached down grasping the tree tops and pulled upward until the roots were freed from the soil and then the trees were dropped. Wood frame buildings under the trees were not damaged.

Over open fields to the east of Henry there was no sign of ground damage for 3 miles. To the south-southeast, where the terrain drops rather sharply from rolling country into the level valley, a tornado moved over a hill about 50 feet in height into the valley, passing directly over a small farm house. The roof was removed from the house and carried away. Two occupants reported that the house seemed "to shake, rumble, and roar" and though it was twisted from its foundation it remained upright. All other farm buildings, including a barn and two sheds, were completely destroyed and carried away. The house was nearer the hill than were the other buildings. In several instances along the tornado path there seemed to be a skip in the destruction on the downward side of a hill that the tornado had passed over.

The storm cell moved south-southeast for approximately 6 miles and then curved and moved directly east for 7 miles. Along this distance there was some wind damage but no evidence of a tornado funnel touching the ground. Seven funnels were observed at one time extending downward but not touching the ground in this section.

<sup>1</sup> A tornado was reported 14 miles northwest of Chugwater, Wyo., at 1 p. m., MST (*Climatological Data, National Summary*, vol. 6, No. 6, June 1955).

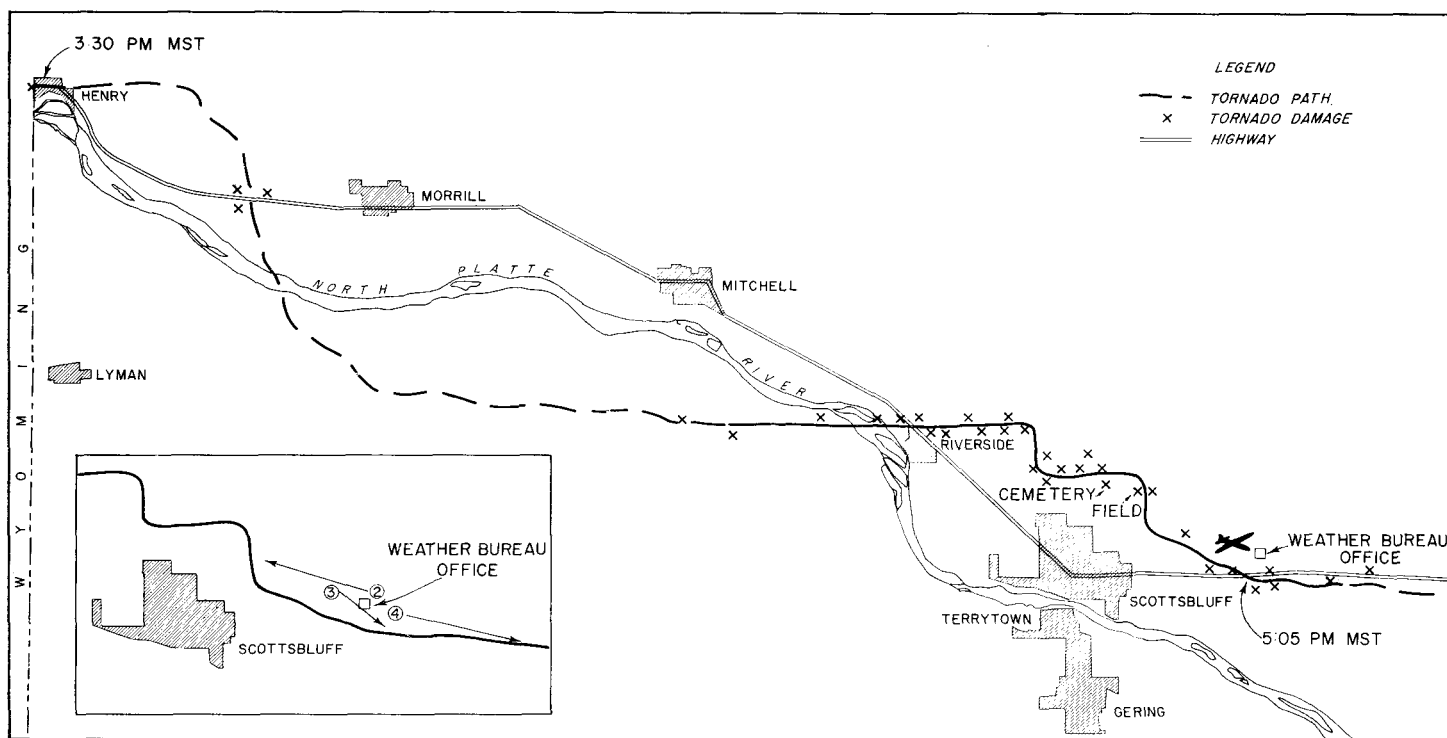


FIGURE 1.—Path of tornado destruction across Scotts Bluff County, June 27, 1955. The dashed portion of the path indicates no evidence of contact with the ground except at Henry and west of Morrill. This portion of the path was determined from photographs and from residents of the area who saw as many as seven funnels at one time along this route. The solid portion of the line indicates continuous contact with the ground. It is believed that north of Scottsbluff there was only one funnel in contact with the ground though there were one to three additional funnels in the same general vicinity that did not reach the ground. Inset shows position of photographer when pictures shown in figures 2, 3, and 4 were taken. Map scale:  $\frac{1}{4}$  inch=1 mile.

From 2 miles south of Mitchell, Nebr., a funnel maintained contact with the ground until cloud dissipation 8 miles east of Scottsbluff. From south of Mitchell the tornado moved due east for 7 miles then turned at right angles to the south for 1 mile, then east for 2 miles, then south 1 mile, then southeast 2 miles, and then east until it faded away. The destructive width of the tornado varied from 200 to 400 yards with the greatest width damage north of Scottsbluff. As the tornado moved across the rural area of the North Platte Valley the only concentration of housing in its path was 3 miles east of Scottsbluff where a housing project of seventeen units, constructed along an irrigation ditch and right in line with the tornado path at this particular distance, was completely destroyed. Two lives were lost. A boy was killed by a truck being hurled upon him as he took refuge in a ditch, and a lady was killed when the car in which she was riding was caught in the tornado funnel. Forty persons were injured and 146 buildings were destroyed or damaged.

### 3. ENCOUNTERS WITH TORNADO CENTER

One of the injured may have had the experience of being in the center of a tornado funnel. The following is an account of his experience. He reports that while driving west on the highway east of Scottsbluff, he noticed a large dust cloud but he did not recognize anything omi-

nous, having observed many more awesome dust clouds in the past; so he proceeded to drive into the dust cloud at a point 3 miles east of Scottsbluff. On entering the dust cloud he realized this was no ordinary disturbance and stopped the car at the side of the road. There was a roar and a crash of glass as the windshield and windows were broken by flying debris. He pulled his wife's head over in his lap and bent over to shield their faces. There was a moment of comparative calm and he raised his head to peer through the broken windshield. Large boards, tree limbs, and a boulder the size of a man's head were floating around the car. When asked the direction of movement he stated without hesitation that the debris was circulating to the left or counterclockwise. Time here was indefinite until there was a crash and that is all he remembers until he regained consciousness in a hospital. Actually both occupants were thrown from the car onto the highway. Both were badly cut and torn. The wife was apparently killed instantly. The car was rolled into an unshapen mass of metal and deposited in a nearby field.

Another case of contact or near contact with the center of the funnel was the experience of three men who were observing and reporting the funnel north of Scottsbluff from a commercial radio mobile broadcasting unit. These broadcasters were ahead of the funnel and to maintain

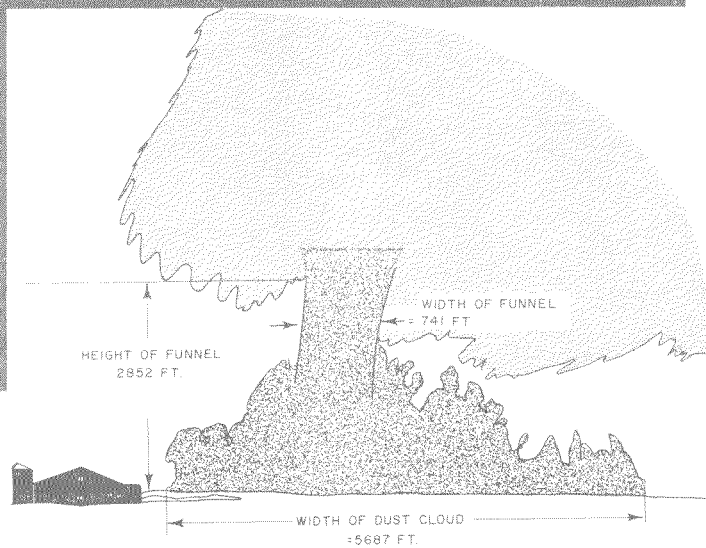


FIGURE 2.—Tornado funnel as seen from near Weather Bureau office at airport. Sketch shows measurements made (See position on fig. 1 inset.)





FIGURE 3.—Tornado funnel photographed from near Weather Bureau office at airport and after time of figure 2. Sketch shows measurements made. (See position on fig. 1 inset.)



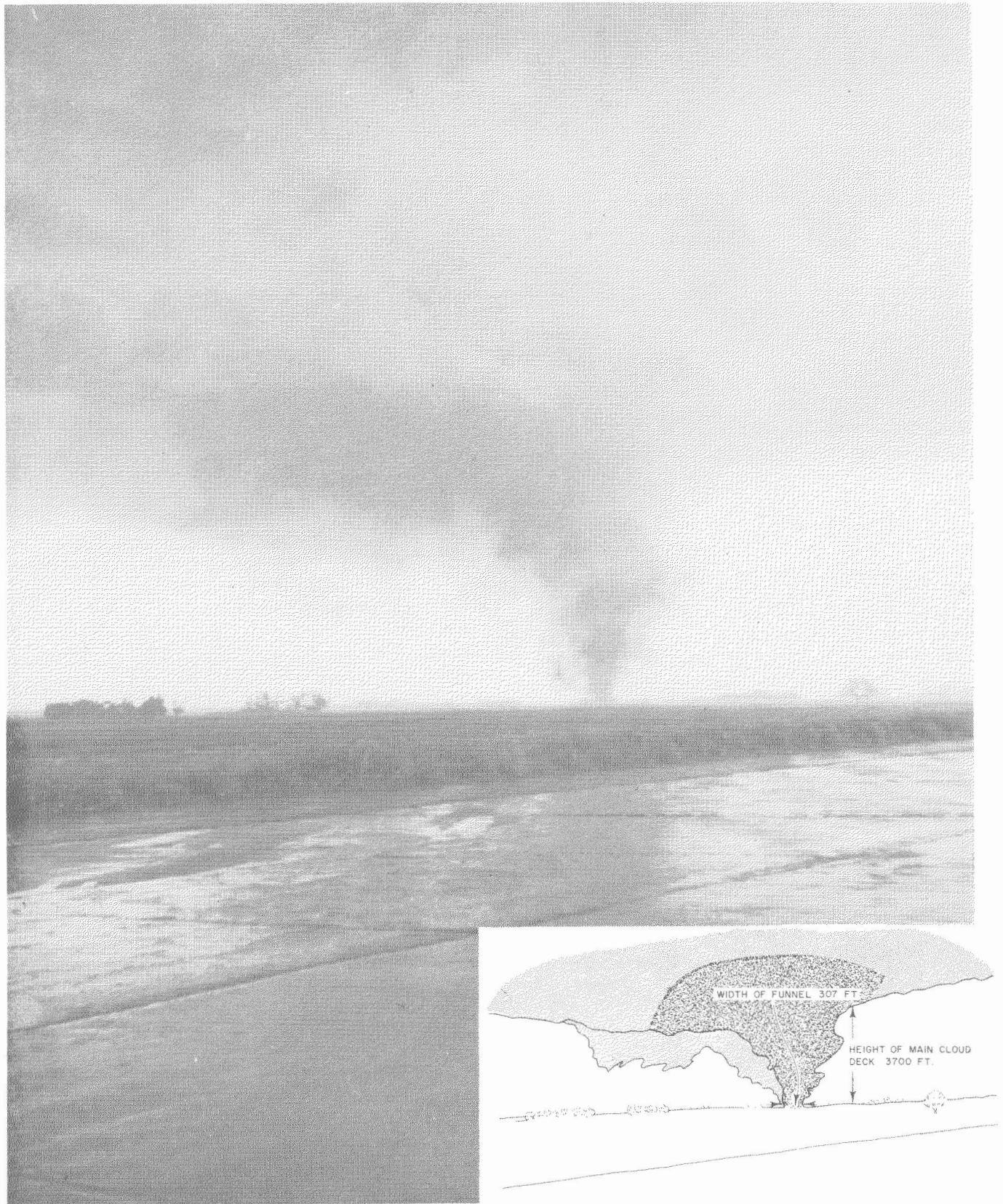


FIGURE 4.—Tornado funnel seen near end of its existence from Weather Bureau office. Sketch shows measurements made. (See position on fig. 1 inset.)

distance they drove through a west gate of a cemetery intending to depart through a south gate. As fate would have it, the south gate was heavily chained and locked. Escape was cut off by the tornado moving over the west gate. The three broadcasters abandoned the mobile unit for the basement sanctuary of a stone building, but left the mobile unit in operation so that the noise of the tornado was broadcast to the public from a distance of not more than 100 feet from the very center of the tornado. This noise was a very audible roar that might be compared to many trains passing in unison. Though the automobile housing the mobile broadcasting unit was damaged to the extent of \$1,200 it remained upright and the broadcasting unit continued to function through the entire period. The broadcasters in the basement or furnace room were having the experience of a lifetime. As they huddled around the furnace they observed tools, such as shovels, hoes, rakes, etc., scoot up the entrance ramp and disappear. Then came total darkness and a deepening roar. The furnace twisted and heaved and the broadcasters found it difficult to breathe. Whether this was due to pressure or lack of such could not be determined. Time in this case seemed to be in minutes and over this time the temperature dropped from a mild summer value until the broadcasters were chilled until they were actually cold. The roar moved on east, light returned, and the broadcasters emerged unhurt to observe the tornado funnel in action continue a slow movement to the east as they resumed voice broadcasting describing the location and action of the tornado funnel. One observation was of large pieces of debris rotating counterclockwise in the funnel and slowly going upward and then suddenly dropping rapidly toward the ground. These large pieces would stop just short of the ground and then again rise slowly while rotating. Measurements showed the building within which they took refuge was within 100 feet of the exact center of the tornado and the building was totally covered by the funnel. The building was only slightly damaged. Other equally sturdy buildings in a relative location to the tornado path were completely destroyed. Neither the broadcasters nor the occupant of the car as reported above observed any unusual light. The static in the radio broadcast from the mobile unit did not blot out the roar of the tornado and it is not believed that it would have blanked out a voice broadcast throughout the period. Voice broadcasts directly before and after the abandonment were audible through the static.

#### 4. PHOTOGRAPHIC MEASUREMENTS

This tornado funnel was widely photographed and it was possible to locate the exact spot from which many pictures were taken and to measure the distance from that point to the path of the tornado. By setting up a surveyor's transit at the spot from which the pictures were taken it was possible to determine the exact azimuth of the funnel and its exact location at the time of the photo-

graphs.<sup>2</sup> Measurements were taken of angles between landmarks shown in the pictures encompassing the tornado funnel, and thus by comparison it was possible to determine the angular width and height of the tornado funnel and the dust cloud. Thus knowing the distance to the funnel and its angular width and height it was possible to measure the width and height of the funnel and the associated dust cloud in feet. Eight pictures (pictures where the path of the funnel was not parallel to the view of the picture) were so measured.

Figure 2 is one of the scaled pictures from which measurements were taken. The view is toward west-northwest from the Scottsbluff Municipal Airport. The following values were obtained for figure 2:

Distance to the funnel=11,162 ft.

Width of the funnel=741 ft.

Height of the funnel=2,852 ft.

Width of dust cloud=5,687 ft.

For figure 3, a picture taken from the Scottsbluff Municipal Airport looking southeast, the following values were obtained:

Distance to the funnel = 11,100 ft.

Width of mid-point of funnel = 220 ft.

Width of funnel at top of dust cloud = 107 ft.

Height of major dust cloud = 871 ft.

Width of major dust cloud = 3,640 ft.

For figure 4, a picture taken from the Scottsbluff Municipal Airport looking east-southeast, the following values were obtained:

Distance to funnel = 18,850 ft.

Width of funnel just above ground = 307 ft.

Height of main cloud deck = 3,700 ft.

#### 5. PRESSURE TRACE

Figure 5 shows the barograph trace from midnight to midnight June 27, 1955, for the Weather Bureau Office at Scottsbluff. The tornado passed one-half mile south of the barograph at 5:05 p. m., MST. The lowest point on the barograph trace was 25.890 inches and occurred 32 minutes prior to the time the tornado reached the nearest point to the barograph. At the time of the lowest barograph reading the tornado was approximately 6 miles to the west-northwest. The several interesting features of the barograph trace deserve further study.

#### 6. RADAR PICTURES

Figures 6 and 7 show pictures taken of the echo on the radar at the Weather Bureau Office, Scottsbluff. The radar was a 10-cm. APS-2F with a 72-in. antenna. The camera used was 35mm, using a 1+ portra lens, a setting of *f*/4, a focusing distance of 18 inches, and a time lapse of one sweep of the radar beam. Eight similar pictures were obtained as the tornado moved from 18 miles to

<sup>2</sup> Mr. D. M. Little, Deputy Chief of the Weather Bureau, suggested that these measurements be made.

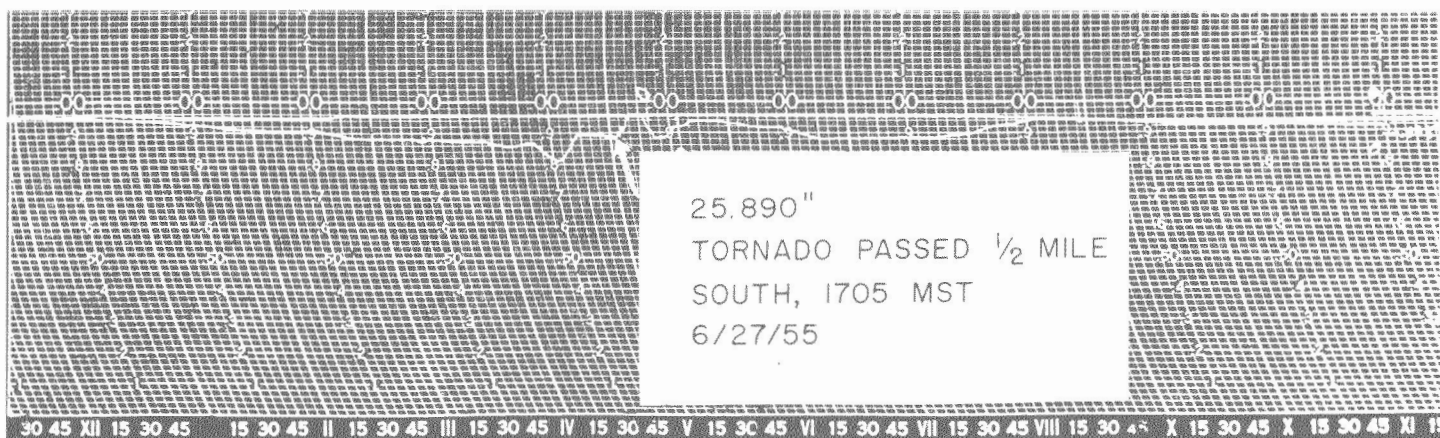


FIGURE 5.—Pressure trace at Weather Bureau office, Scottsbluff, during passage of tornado to the south.

within  $2\frac{1}{2}$  miles of the radar. The hook or “number 6” appearance of the cloud echo was in evidence at about 19 miles distance becoming more pronounced as the tornado came closer to the station. The tornado passed one-half mile south of the radar (see fig. 1) cutting off all power so no view of the dissipation of the tornado cloud was observed on the radar.

#### 7. UNUSUAL GROUND MARKINGS

Figures 8 and 9 are aerial photographs of some unusual markings in a cultivated field northeast of Scottsbluff

(see fig. 1) that were caused by the tornado. A heavy rain shower followed the tornado over the field and some 40 hours elapsed between the time the tornado passed and these marks were photographed. The field had been planted in potatoes and beans and at the time the cultivated soil was very loose and fine. When noted, these marks were ridges or dikes from one-fourth to one-half inch in height and were arranged in waves similar to ripples on a pond. The surface soil was impregnated with a fine gravel that was not native to the field. There could be considerable speculation as to how the tornado

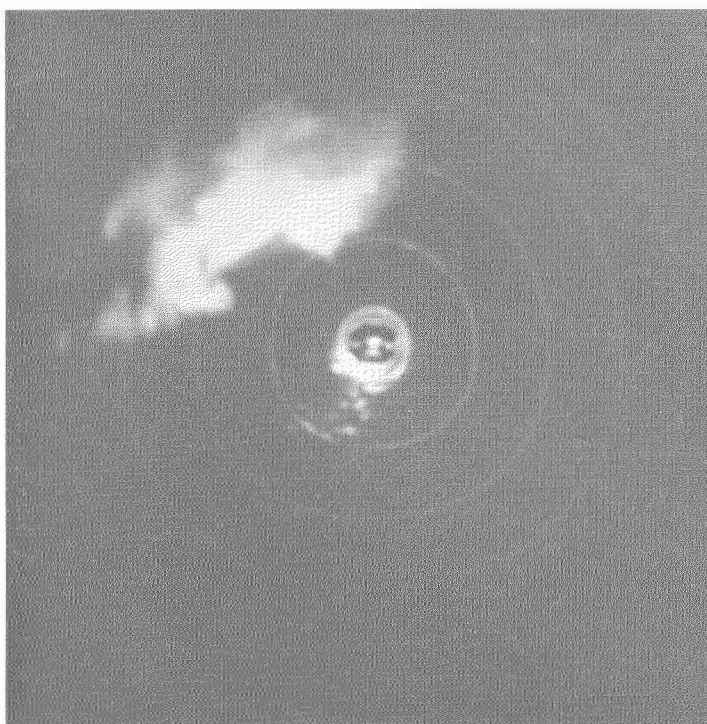


FIGURE 6.—Photograph of echo on radarscope at Weather Bureau office, 1555 MST, June 27, 1955. Range marks are at intervals of 5 nautical miles, tilt is  $4.9^\circ$ . Position of tornado is marked by hook-shaped echo at azimuth  $288^\circ$  and 14.5 nautical miles distant.

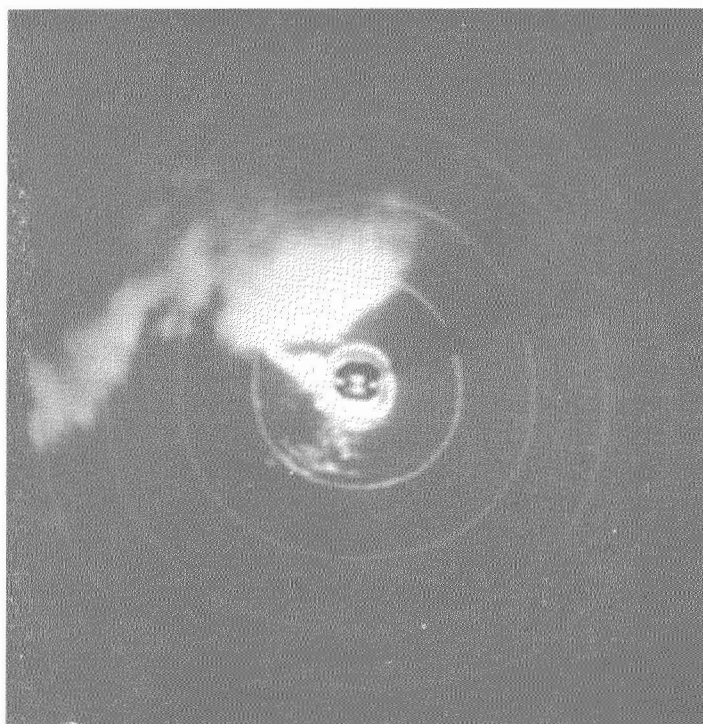


FIGURE 7.—Radar echo at 1635 MST, June 27, 1955. Tornado is at azimuth  $282^\circ$  and 6.0 nautical miles distant. Range marks are at intervals of 5 nautical miles, tilt is  $6.4^\circ$ .





FIGURE 8.—Aerial photograph of cultivated field near Scottsbluff showing elliptical markings made as the tornado passed. Note change in direction of path.

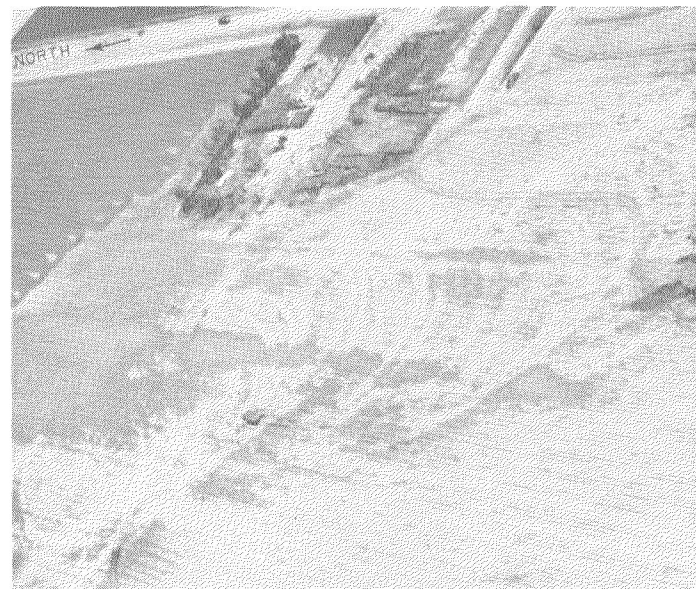


FIGURE 9.—Another view of same field as shown in figure 8.

produced these marks. That is left to the imagination of the reader.

A ground survey did not show a pattern in the markings for obtaining measurements. However, the pictures show systematic markings and the field was measured in order that the pictures could be scaled. Apparently these markings form a near ellipse. In the following computations it is assumed they are a true ellipse. The forward speed of the tornado cloud cell as determined by the radar gave an estimated forward speed of the tornado of 12 m. p. h. From the scaled photographs it was determined that the diameter of the major axis of the ellipse was 230 feet and the diameter of the minor axis was 152 feet. By averaging distances between rings at the center of the leading edge over as nearly a uniform portion of the markings as possible it was determined that this average distance between markings was 15 feet 4 inches. Assuming the marking to have been made by something being carried with the speed of the revolving wind within the tornado funnel, the wind speed was determined from the relationship

$$V = CNS$$

where  $V$  is wind speed

$C = 2\pi\sqrt{(a^2 + b^2)}/2$  is approximate circumference of an ellipse

$N$  is number of rings per unit distance

$S$  is forward speed of the tornado

$a$  is one-half the major axis of an ellipse

$b$  is one-half the minor axis of an ellipse

With this relationship the numerical values from the scaled photographs give  $V = 484$  m. p. h. for the speed of

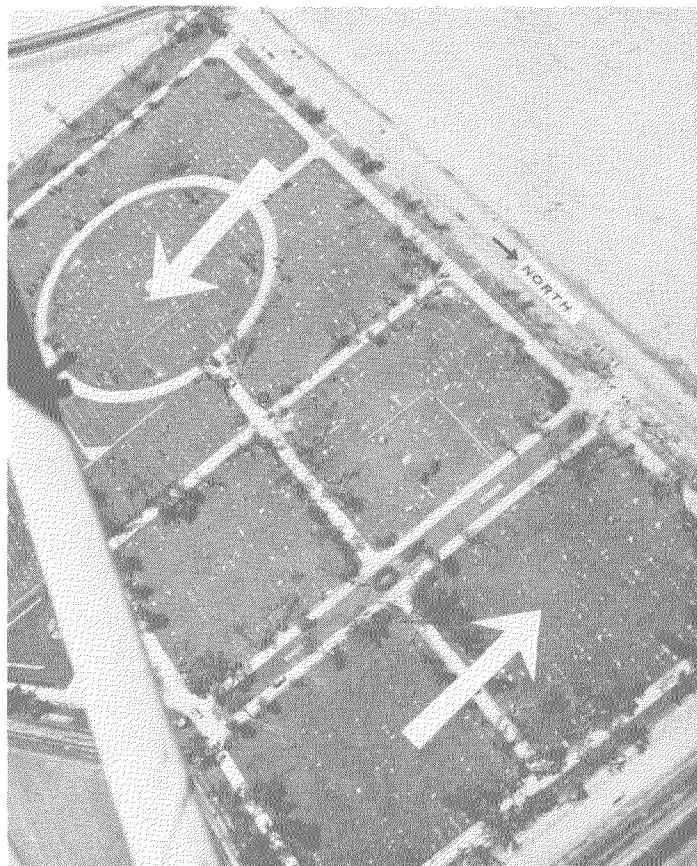


FIGURE 10.—Aerial view of cemetery showing direction in which grave markers were felled. Trees also show rotation in their different directions of fall.

the wind in the tornado funnel. It is emphasized that this result is based on an estimated forward speed and on the unconfirmed assumption that the elliptical markings were made by an object that made exactly one revolution about the vortex for each marking.

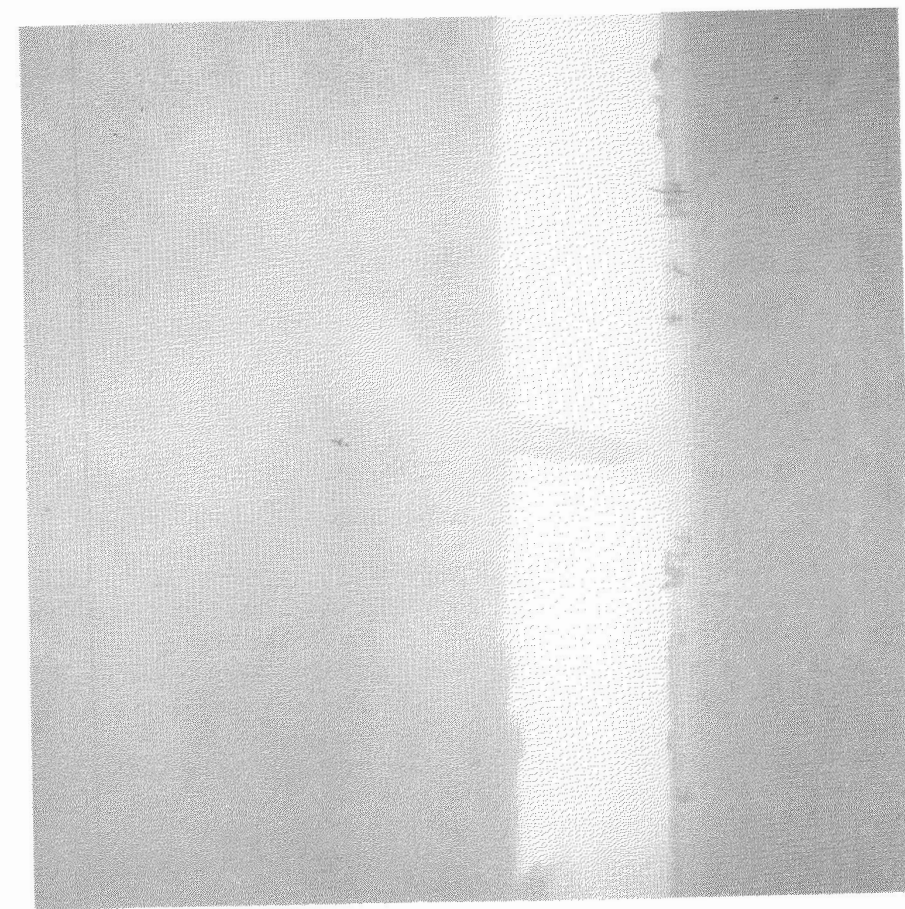


FIGURE 11.—Tornado near Mitchell showing the funnel shape of the protuberance.

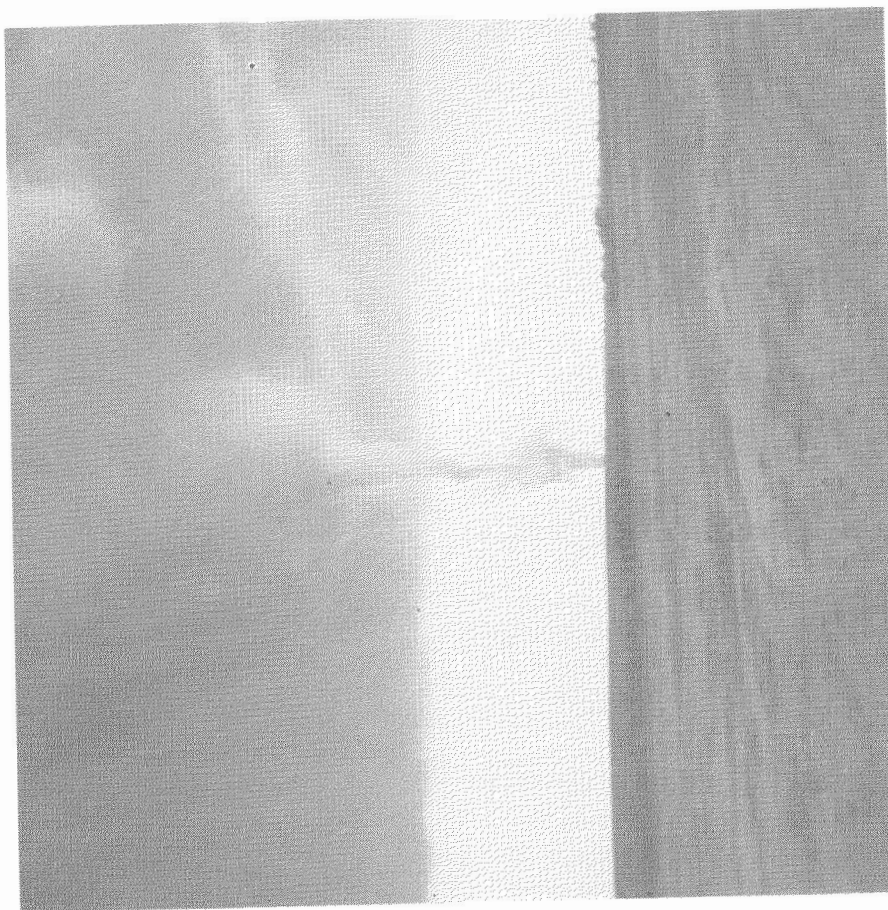


FIGURE 12.—Dust cloud rising to meet funnel in Mitchell area.

Not only did the motion of the funnel's contact with the ground vary from side to side, but as shown by sequence pictures the lower part of the funnel both ran ahead and trailed behind the upper part of the funnel. Whether or not this was because of a backward movement of the lower part of the funnel or because the lower part remained stationary until the upper part passed is not shown by the still photographs. The 90° bend in the markings in the field as shown in figure 8 is evidence of a sudden change in direction of the lower part of the funnel. The staircase line of the tornado path near Scottsbluff as shown in figure 1 is an indication of abrupt direction changes.

### 8. DOWNDRAFTS

There were three reliable reports of severe downdrafts on the south side of the tornado. An observer a short distance south of Henry reported he could see a dark cloud in the sky but no funnel. He experienced surging blasts of wind that seemed to drive his car into the ground. An almost identical occurrence was reported four miles south of Morrill. One of the meteorologists at the Scottsbluff Weather Bureau Office who was driving his car on the highway a few hundred feet south of the tornado funnel as it passed 2½ miles east of Scottsbluff observed cold downdrafts that actually bounced his car up and down. Shortly after the passage of the tornado the writer observed sticks and shingles that had been driven into the ground by the tornado at about a 60° angle with the tops leaning northwest. These were in the vicinity where the Weather Bureau meteorologist observed the cold downdrafts. Outside the tornado funnel on the north side winds were comparatively light. At the Weather Bureau Office, one-half mile north of the tornado, the maximum wind speed was 30 m. p. h. On the south side of the tornado winds were estimated at 50 m. p. h. for a distance of 8 miles.

### 9. WIND ROTATION

There was evidence that the winds within the funnel were rotating counterclockwise. The writer observed distinct cloud movement to that effect. West of Morrill the tornado funnel had the appearance of a large whirlwind and several observers reported that debris could be seen circulating to the left. The statement by the person injured in the automobile and the observations by the radio broadcasters support the counterclockwise evidence. Further evidence of the counterclockwise movement is shown in figure 10. As indicated by the arrows in this picture the grave markers on the north side of the cemetery were toppled to the west and the markers on the south side were toppled to the east; in a strip through the middle, for a width of approximately 50 yards, the markers were not disturbed. The tornado passed from west to east through the cemetery and the wide facings of the markers face east and west while the narrow portions face north and south. Many of the markers toppled weighed over 3,000 pounds. The trees on the north side

of the cemetery were felled to the west and on the south side to the east.

### 10. SHAPE OF PROTUBERANCE

This was perhaps the most photographed tornado occurrence in history. Forty-eight funnel photographs were collected and studied. These pictures, which ranged over a distance of 23 miles show that from near the Wyoming State line to just north of Scottsbluff the protuberance was actually funnel shaped, that is wider at the base of the cloud than at the lower extremities. Figures 11 and 12 taken in the Mitchell area show this funnel shape. From just northeast of Scottsbluff to the tornado's dissipation, photographs show the protuberance was post shaped or the same size through its full length. Figures 2, 3, and 4 were taken when the tornado was north or east of Scottsbluff toward the end of its history.

Figure 12 indicates a dust cloud rising to meet the funnel from the cloud. Several of the photographs studied showed similar situations. Some showed the dust cloud on the ground with a clear space between the dust cloud and the funnel above. In others it appeared that the funnel was touching the ground with a portion of the funnel near its midpoint removed.

### 11. WEATHER CONDITIONS

The tornado situation of June 27 followed torrential rains of June 26 in eastern Wyoming and western Nebraska. On the afternoon and night of June 26 rains of 2 to 6 inches caused severe flash flooding for a considerable distance along the Platte Valley in eastern Wyoming and for about 8 miles into western Nebraska. The weather the morning of June 27 was generally fair. There were scattered to broken stratocumulus clouds at 2,500 to 4,000 feet above the ground, winds were southeasterly 10 to 15 m. p. h., mid-afternoon temperatures near 80° F. with a dew point in the sixties. A typical swelling cumulus cloud, as indicated by the radar, began to develop in eastern Wyoming about 1230 MST moving eastward down the North Platte Valley into Nebraska and increasing in size and intensity spreading horizontally until it was approximately 20 miles north-south and 10 miles east-west. Outside this cell area there were only scattered cumulus clouds of weak to moderate intensity. The tornado was followed by a brief heavy rain shower and some hail. Rainfall amounts varied from ¼ to 1 inch over a strip about 3 miles on each side of the path of the tornado. Several reports of a "rain of mud" were received from the north side of the tornado. Evidence of the deposits of mud could be observed along the north side of the tornado path, generally within ½ mile. There were spotted patches of hail within the rain area and most of the hailstones were generally less than ¼ inch in diameter. However, in the vicinity of Mitchell a few hailstones the size of baseballs were reported to have fallen. With the rain shower the winds shifted into the west and with the ending of the rain shower behind the funnel skies cleared as the cloud cell moved or dissipated to the east.